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The Old Technical-School Tie

Last Sunday night we listened to an erudite talk by the President of the Institution of Civil Engineers, in which at an early stage he made some propaganda for the reservation of the title of engineer to those who adopt it as a profession rather than as a trade, as is the case on the Continent. The speaker mentioned that everybody had a good idea as to what the title doctor stood for, but with this we cannot agree, as if one sees either the composition of a continental cabinet or a technical committee of a scientific institute, the appellation "doctor" will cover a particularly wide range of professions. The continental title of engineer certainly does usually denote that its bearer is properly qualified professionally, but to seal it the visiting card must additionally give an indication of the university or school from which the title holder has graduated. In theory, this system is excellent; in practice it is abominable and one which we would not like to see imposed on British industry. The evils are twofold. Primarily, a hardworking trade apprentice may spend all his spare time applying himself to the theory and practice of his calling and his reward can be no greater than that of being appointed to the position of foreman. The whole of the higher executive positions together with their staff assistants are reserved for "engineers." The second evil is the ridiculous extent to which the highest officials favour ex-students from their old school. We have heard much about the old school tie in this country, but it sinks into insignificance compared with the favouritism existing in certain walks of continental life. For instance, no "engineer," unless he had been trained at the "Ecole des Arts et Métiérs" would ever think of applying for a job on the French railway system. Again, the general manager of the largest armament factory was accidentally killed and his successor dismissed practically the whole of the supervisory staff and filled the vacancies so caused by "engineers" trained in the same school as himself. As to these continental college trained "engineers," we have found from working side by side with them, that they are, with, of course, plenty of brilliant exceptions. quite unpractical, and the majority would not hold their job down for a month in either a British or American works, whilst, on the other hand, the foreman would have been promoted to the position of manager. Moreover, in several of the largest continental works at which we have been employed, the works manager, and the outstanding brains of the concern, had worked as workmen in the United States or Great Britain or both countries. Again, the continental engineer seems to have an aversion for practical work, for fear he should lose caste by getting his hands dirty, and repeatedly we have been told when personally endeavouring to bring a steelmaking slag to perfection, or adjusting the electrodes to our liking, "Monsieur, ce n'est pas pour vous, vous êtes ingenieur!" Thus we hope that in a campaign directed towards the reservation of the title "engineer" to the professionally-trained, there will be no ancillary effort made for a "closed shop" policy by postulating the exclusion of works-trained lads from the higher positions. British and American engineers have kept themselves in the forefront of their professions when examined from an international aspect and this has been done without the aid of the "old technical-school ties." The difference between English and continental interpretation of the word "engineer" is not apparently understood by the popular Press, so that when there is an engineers' strike at Essen, Prague or Le Creusot, the British public is informed that the metal workers, or sometimes the metallurgists, have downed tools! This is due to the fact that in French, at any rate, fitters, erectors, blacksmiths and moulders are designated "métallurgistes."

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INSTITUTE OF BRITISH FOUNDRYMEN

NEW MEMBERS

At a meeting of the Council of the Institute of British Foundrymen held last Saturday week at the Queens Hotel, Birmingham, the following were elected to the various grades of membership:—

As Subscribing Firm Members.—Brown, Duncan & Company, Hawthorn Road, Bootle, Liverpool; Non-Ferrous Casting Company (Birmingham), Limited, Grove Lane, Smethwick, Staffs; H. J. Creese & Sons, Syston Foundry, Syston, nr. Leicester; Glacier Metal Company, Limited, 368, Ealing Road, Alperton, Wembley, Middlesex.

As Members.—E. Amos, foundry foreman, Tubal Cain, Limited; J. Bain, works director, Paterson, Hughes Engineering Company; J. L. Caldwell, manager, Northern Die-Casting Company, Limited; H. J. Creese, proprietor, H. J. Creese & Sons, Syston; H. C. Dawson, mechanical engineer, H. A. Brassert & Company; K. J. Edwards, technical director, Coleman Foundry Equipment Company; E. R. Francis, research chemist, Assistant Editor "Foundry Trade Journal"; D. P. Greenwood, technical representative, Foundry Services, Limited; E. J. Groom, Editor, "Light Metals"; G. Hookham, mechanical engineer, H. A. Brassert & Company; A. McLeod, Editor, "Sheet Metal Industries"; J. F. Bowles (transfer), foundry manager, Titan Foundry Company; F. L. Topham, foundry manager, Bennis Combustion; E. J. Pike, chief information officer, High Duty Alloys, Limited, Slough; W. J. Pym, brassfounder, J. C. Pym & Company; M. G. Raju, attached London Office, Chief Engineer, S. Army, India; A. C. Rao, superintendent military engineer, attached Chief Engineer, S. Army, India; T. H. Summerson, director, Steel Castings, Ministry of Supplies; E. R. Waddington, Air Ministry examiner, Brockhouse Engineering Company; A. E. Wagstaffe, proprietor, Machine Pattern Company, Slough; M. R. M. Roy, superintendent military engineer attached Chief Engineer S. Army, India; J. McI. Shand, foundry manager, Tubal Cain Foundry; F. Woudhall, foundry manager, Willey & Company, Limited; G. M. Banks, technical area manager, T. W. Ward, Limited; T. Hogg, metal merchant; P. T. Holligan, research manager, Glacier Metal Company; F. T. Jones, production manager, W. Tagg & Company, Limited; W. A. Jones, technical advisor, Foundry Services; R. Lewis, foundry manager, W. Tagg & Company, Limited; R. H. Mackintosh, assistant manager, Miller & Company, Limited, Edinburgh; J. G. Nisbet, ironmoulder, Rolls Royce, Limited; J. S. Pearson, representative, Cameron & Roberton, Kirkintilloch; W. E. Williams, works manager, Williams Alexander Foundry.

As Associate Members.—G. A. Broadbent, wood patternmaker, Leys Malleable; J. H. Broadhead, metal patternmaker, Leys Malleable; A. Ceriez, foundry foreman, Cardiff Foundry & Engineering Company, Limited; J. E. Farrar, engineering patternmaker, C. V. A. Jig Moulds & Tools, Limited; N. Greenwood, metallurgist, Mather & Platt; L. A. Hamilton, metallurgist, Tubal Cain Foundry; A. S. Haxell, foreman patternmaker, Manganese Bronze Company, Limited; D. Davies, moulder, Brown Lenox & Company; G. Knott, ratefixer, Worthington Simpsons; J. D. Leishman, metallurgical chemist, Leys Malleable; R. Maddocks, castings inspector, Leys Malleable; J. Merryweather, foreman patternmaker, Sykes & Harrison; J. Ollerenshaw, foreman patternmaker, J. Adamson & Company; W. Payne, ratefixer, Markham & Company; W. M. C. Peterson, assistant metallurgist, Curran Steels; J. O. Price, foundry foreman, C. V. A. Jig Moulds & Tools, Limited; A. Roberts, apprentice moulder, Blakeborough & Sons; D. H. Scott, assistant foundry foreman, Markham & Company; A. Spencer, metallurgist, Blakeborough & Sons; J. L. C. Swarris, draughtsman, M.U.R.A.F. Sind.; P. B. Walters, assistant metallurgist, Butterley Company, Limited; A. Wood, foundry foreman, Blakeborough & Sons; B. Simpson (transfer), foreman moulder, S. Russell & Sons; H. Allender, patternmaker, Rainwater Castings, Limited; L. Chilton, patternmaker, Oilwell Engineering Company, Limited; A. Davidson, underforeman, Harland & Wolff; S. Marner, iron moulder, J. Hall & Son, Limited; A. H. Millward, brass moulder, Mather & Platt; F. S. Yates, metallurgist, Craven Bros. (M/c.), Limited; A. Swann (transfer), assistant foreman; D. Davies, moulder, Brown Lenox & Company; W. K. Davies, moulder, Brown Lenox & Company; H. Edy, foreman moulder, Tubal Cain; D. W. Harris, moulder; A. H. McClure, assistant metallurgist, Rolls-Royce, Limited; V. C. Rogers, chemist, Cwmbran Engineering Company; A. S. H. Sawers, patternmaker, Cruikshanks & Company; K. G. Walker, steel moulder; A. Watson, metallurgical assistant, L.M.S. Loco Works.

As Associates.—R. L. Smith, apprentice marine engineer, N.E. Marine Engineering Company, Limited; D. E. Arundel, foundry student, Worthington-Simpson.

As Students.—M. R. James, student moulder; I. T. Powell, apprentice moulder, Brown Lenox & Company.

These elections bring the membership of the Institute to over 1,500.

THE ASSOCIATION OF BRONZE AND BRASS FOUNDERS

(*Concluded from page* 192.)

Mr. G. T. Hyslop, of Phosphor Bronze Company, Limited; Mr. B. S. Barham, of Dewrance & Company, Limited; Mr. A. J. Murphy, of J. Stone & Company, Limited; Mr. F. Hudson, of the Institute of British Foundrymen (co-opted); Mr. G. L. Bailey, of British Non-ferrous Metals Research Association (co-opted); Mr. Frank Evans, of Langley Alloys, Limited; Mr. Loosen, Junr., of Anti-Attrition Metal Company; Mr. N. MacLeod, of Steven & Struthers, Limited; Mr. J. E. Newson, of Manganese Bronze & Brass Company, Limited; Mr. Osborne, of Merryweather & Sons, Limited; and Mr. Robertson, of Non-Ferrous Die Casting Company, Limited.

Both the provisional Council and Technical Committee met during the afternoon following the meeting.

THE FOUNDRY INDUSTRY AND AIR WARFARE — III

A LIGHT-ALLOY FOUNDRY OF ROLLS-ROYCE LTD.

Heat-Treatment — Aluminium Die-Casting — Problems of Die Design in the Production of Merlin XX Aero Engines

(*Concluded from page* 144.)

Heat-Treatment

After the casting has passed inspection it is transported by conveyor to the heat-treatment furnace (Fig. 42), from which it will be seen that loaded bogies are intermittently charged into the furnace by push-button controlled electrical pusher gear. The furnace is 88 ft. long and is divided into three zones, preheating to bring the charge up to the correct temperature; soaking, in which chamber the castings remain for an 8-hr. period; and, finally, cooling. The intermediate doors between the various zones are electrically interlocked with the pusher gear, and transfer cars so that the operation of the furnace is as nearly foolproof as possible.

Rapid recirculation of hot air is the heating medium used, no products of combustion being allowed to enter the furnace. The air is heated by means of two large air heaters which are located above the furnace. The accuracy of the control of temperature which is regulated and maintained by fully automatic pyrometric control gear, being of the order of plus or minus 2 deg. C. of the desired figure throughout the full length of the preheating and soaking zones.

Wired to each casting before entering the furnace is the appropriate test-bar to conform to A.I.D. requirements, so that all castings leaving the furnace are discharged into quarantine stores pending the completion of the mechanical tests on the bar and the issue of the release note.

Obviously, there are several outstanding advantages of this type of furnace over the batch type. First, the whole of the castings processed (approximately 30 cwts. per hr.) are loaded, treated and discharged by one man; secondly, economy in fuel costs; and thirdly, absolute uniformity of treatment with the continuity of line flow production.

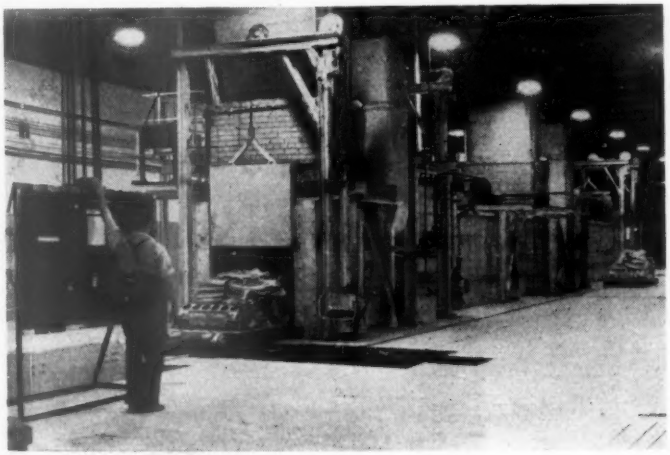

FIG. 42.—CHARGING CASTINGS INTO HEAT-TREATMENT FURNACE OF ELECTRIC PUSHER GEAR.

Aluminium Die-casting

The advantages to be gained by casting aluminium alloys into metal moulds, whether by gravity and pressure methods, can be generally covered by three principal factors:—(1) Increased rates of production over sand-cast methods; (2) narrower limits of dimensional accuracy are possible; and (3) improved mechanical properties of the casting. That Rolls-Royce, Limited, have adopted a policy of producing as many castings as possible on the Merlin engine as die-castings is very evident, when one is informed that of the 147 castings on the engine, 101, or 76 per cent. of the total, are produced as die-castings.

Some of the castings produced involve the use of sand cores to form internal passages, although the foundry die designers, in collaboration with the production engineer, endeavour to modify designs to eliminate the use of sand or multi-piece cores as far as possible. Our representative was shown numerous examples of how designs had been altered by the production engineer at the request of the foundry, with the result that potential causes of scrap castings were eliminated, and production output from the die greatly increased.

The whole of the design and manufacture of a new gravity or pressure die is carried out within the foundry organisation, and on completion the new die is passed into a "proofing" die-casting department, where the best method of coating the die and pouring the casting along with other essential

A Rolls-Royce Light-Alloy Foundry

features, such as pouring temperature, production rate, etc., are determined. With these essential details tabulated, the die is then released to the production die-casting department, which can then go ahead turning out castings without any further difficulty, other than the usual maintenance work on the die.

There are three alloys in general use in the die-casting section, namely, B.S.S. 4L11, B.S.S. L33, and B.S.S. RR50. The use of 4L11 is generally limited to those die-castings in which the best possible bearing properties are required, whilst L33 is used mainly in the production of castings such as the rocker cover (see Figs. 8, 9, and 10), which could not be produced in RR50 satisfactorily owing to its long thin design necessitating maximum fluidity in the alloy used.

FIG. 43.—COOLANT PUMP GRAVITY DIE

In cases where the casting is heavily undercut or where it would be impossible to use a steel core, sand cores may be used and removed from the casting by knocking out afterwards. Such an instance is the die for the coolant pump casing shown in Fig. 43 and cast in RR50 alloy. Due to the presence of sand cores which have to be renewed after every casting this is not a die-casting in the true sense of the word, and is sometimes referred to as a semi-die-casting.

The design of dies with sand cores involves problems similar to those met with in sand-casting practice, namely: (*a*) The provision of a suitable design of core print which will ensure accuracy and consistency in core location; (*b*) adequate venting arrangements for drawing off the core gases generated at the moment of casting. Both these conditions are provided for in the design of the coolant pump die shown.

The volute core is located and set at the ends as shown, whilst venting is effected by running a vent right through the core and exhausting at each end to atmosphere. The smaller centre core in the illustration (Fig. 43) is located on its base on four pins projecting out from the bottom of the die. Owing to the fact that this core forms a blind pocket in the casting and that core gases naturally tend to rise, venting by ordinary methods is difficult. For this reason, the four location pins mentioned above are tubular in form, and a system of artificial venting which draws out the gases through the base of the die is used.

FIG. 44.—COVER PLATE AND GUIDE GRAVITY DIE.

A Rolls-Royce Light-Alloy Foundry

After pouring the casting the die is parted and the casting is removed from the die base by means of ejection pins pushing on appropriate places of the casting and connected to an ejector mechanism operated by a rack and pinion arrangement incorporated in the base of the die. By this means, the casting is removed easily from the die without distortion or, in the extreme cases, cracking. The die for the cover plate and guide and a casting therefrom complete with runners and risers is shown in Fig. 44. The alloy used is again RR50. Owing to the complicated shape of the casting, this part is difficult to produce as a die-casting without a combination of good die designing, accurate tool making and sound die-casting foundry practice.

From the die designer's point of view, it is obvious that the irregular form of the casting demands a smooth flow of metal to the bottom of the die cavity, then filling by displacement to produce castings free from the defects inherent to turbulent pouring. At the same time, consideration must be given as to the most favourable thermal conditions existing in the mould, that is, progressive solidification towards the source of feed or heat. To obtain the ideal conditions, the down runner has been broken across half way up the casting into a boss which requires feeding and then into the bottom of the ring riser where hot metal is most essential. The down runner is inclined at an angle to promote a smooth flow of metal into the die.

The large number of undercuts present on the casting makes it necessary for most of the shape to be incorporated in loose pieces which are picked off the casting after opening the die blocks. Owing to the fact that all these loose pieces are located and slide in the main die blocks, it is essential that the blocks open perfectly parallel to avoid wrenching the loose pieces which would lead to cracks on the casting. To overcome this difficulty, the blocks run in guides and a special opening device has been included on the die base whereby pressure on the handles projecting out from the side of the base rotates the cams shown, and opens the blocks an equal amount on each side of the joint line, thus leaving the casting suspended on the bottom core. One small sand core clearly shown in Fig. 44 is used to form the triangular shaped pocket on the casting.

Although the design is made as foolproof as possible, considerable skill and care are required in the manipulation of this die, in order to avoid damage to the delicate cores and ensure the correct position and alignment of same. Besides having an insulating and protective coating on them, the loose pieces are dipped after every cast in a suspension of graphite and water, the purpose of which is lubrication to facilitate easy withdrawal from the casting. After dipping the pieces are suspended over a gas ring to maintain them at a uniform working temperature. Despite the fact that there are 5 pick-off pieces, 8 cores and a sand core, two men can maintain a production of 12 castings per hr. with less than 5 per cent. rejections.

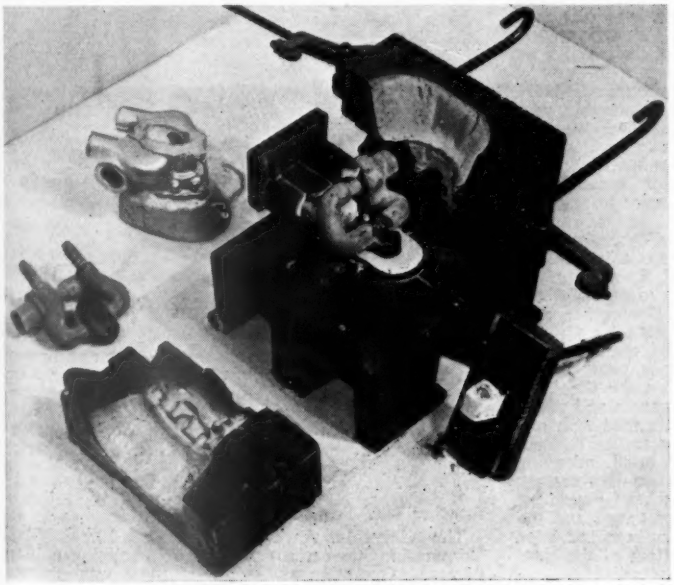

FIG. 45.—FUEL PUMP GRAVITY DIE.

A further example of a semi-die-casting die is shown in Fig. 45. The casting is the fuel pump and is made in B.S.S. 4L11. A sand core is shown in Fig. 45, together with an underneath view of same, indicating the core-printing system. Owing to the relatively even section of the casting and the characteristics of the alloy being cast, a single header is sufficient to provide feed and at the same time act as a runner. Care is required in pouring, however, by this method to avoid sand being washed off the core, as well as air locks and oxide inclusions.

A typical casting representative of many produced by the die-casting process is the boost, made in RR50 alloy. This particular instance reflects the great advantages to be gained by die-casting. In comparison to the die-

A Rolls-Royce Light-Alloy Foundry

casting, the sand-casting is difficult to produce, owing to the fact that numerous cores have to be used in the construction of the mould, these increasing cost and slowing up production, besides ensuring high risk of scrap due to the number of hands the mould passes through before completion. Furthermore, the presence of cores and chills in the mould leads to the appearance of flashes and chill marks, resulting in a casting of much inferior finish and accuracy.

Casting Suitable for Die-Casting

On the other hand, the form of the casting and the disposition of the thick and thin sections lends itself to die-casting, allowing the designer to design quite a simple die of reasonable initial cost capable of producing thousands of sound castings. The casting is situated in the die in a manner which ensures sufficient feed to all heavy sections, whilst maintaining simplicity in design. The casting is top poured by a skilled caster, the metal entering the mould slowly with the minimum of turbulence. Where top pouring is employed, ample ventilation of the die cavity is essential to allow for a free egress of air in front of the ingoing metal. For this reason, numerous risers have been placed all round the casting to give direct ventilation to the atmosphere.

The gravity die for the front gear casing and a casting therefrom is shown in Fig. 46. This is cast in RR50 alloy. Close co-operation between the die designer and the production engineer is essential on a job of this description, in an endeavour to make the job as simple and straightforward as possible, with a view to deleting any unnecessary undercuts, and allowing ample taper for extracting the casting from the die when cast. Any design alterations of this description are, of course, permissible only provided the function and strength of the casting is not in any way impaired.

As can be seen from Fig. 46, the die consists of a substantial die base in which is situated a large core. This contains all the bottom form of the casting and is actuated in a vertical direction by means of three equally spaced "two-start" square threaded screws connected by a link motion and operated by a single lever projecting out from the side of the die. The circumference contour of the casting is contained in three form blocks sliding in guides on the die base. These form blocks also embody the runners and risers. The internal portion of the casting is formed with one large core located in the runner blocks.

Owing to the nature of the alloy used, adequate feeding of the metal during solidification is necessary and for this reason a heavy riser has been placed all round the casting in order to feed the flange and the heavy bosses thereon. The three heavy bearing bosses and adjacent thick sections in the bottom of the casting are fed by means of the conical risers shown. Besides ensuring a casting free from all shrinkage defects, adequate venting of the die is also necessary to maintain good definition and obviate misruns. Webs are vented by splitting the core along their length and venting the joint lines thus formed; where jointing is impracticable, split vent plugs are inserted at appropriate places.

The metal is poured into the die at a temperature of 710 to 720 deg. C. down the three sloping runners; these ensure a smooth flow of entering metal, resulting in castings being free from air inclusions, whilst a three-position pour is advantageous, as it maintains a uniform temperature throughout the mould and individual rates of pour are kept to a minimum, thus alleviating the risk of turbulence.

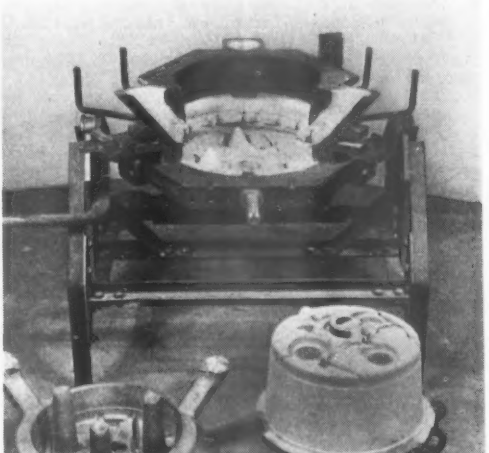

FIG. 46.—GEAR CASING DIE.

It is obvious that a great saving in time and money can be effected by making a casting of this description from a die, as compared with the sand-casting process, both from the foundry and machine-shop points of view, as casting can be maintained to a consistent degree of accuracy and uniformity with a much superior finish.

Another Blast-Furnace Relining Record

The Gary, Ind., works of Carnegie-Illinois Steel Corporation has set a new record in relining a blast furnace. Operation of the blast furnace was resumed after a record relining time of 21 days 3 hrs. 50 mins. The relining of the furnace was from the mantle up.

THE ASSOCIATION OF BRONZE AND BRASS FOUNDERS

INAUGURAL MEETING

This new and important body came into being at a meeting held at the Queen's Hotel, Birmingham, yesterday week. The meeting was presided over by Mr. H. Bissell, of J. Stone & Company, Limited, and Mr. Heathcote, of Heathcote & Coleman, acted as secretary.

In the course of his remarks, MR. BISSELL said the industry was indebted to certain members of the Non-Ferrous Sub-Committee of the Institute of British Foundrymen for being the germ of the idea that an Association should be formed in the bronze and brass foundry industry, and in connection with which he was asked to set the wheels in motion, a little more than three weeks ago.

Without giving away secrets, he thought he could disclose that when a suggestion was made that the iron-foundry interests should take care of foundry interests as a whole, the members of the Non-Ferrous Sub-Committee of the Institute of British Foundrymen strongly objected, and the support so far given to the formation of a new Association certainly showed that many shared this indignation. He was indebted to Mr. F. Hudson, personally, for his valued help and advice, and particularly in allowing him to cull some of his own observations.

Fuel Efficiency—The Impetus

The immediate question which had created this activity was that of fuel efficiency. The latest steps taken by the Ministry in connection with the saving of fuel in the engineering and allied industries was to confer with industry committees to work in conjunction with the Regional Fuel Efficiency Committees and Regional Fuel Officers appointed by the Ministry.

The principal object of this liaison was to gather together the experience of engineers and technicians in any particular area so that advice could be given to any firm in that area in connection with fuel matters. The Council of Iron Foundry Associations had similarly formed industry committees to represent iron-founders' interests, but difficulties arose in connection with bronze and brass founders, as there was no recognised particular organisation to represent that group as a whole. True, there is a Brassfounders' Employers' Association in existence, although perhaps very few of those present that day were aware of that fact until quite recently. This Association, he believed, had been in existence for a very large number of years, but its activities had in the past been confined more particularly to firms in the Birmingham area and had dealt with questions more of a nature affecting that section of the brass foundry industry, in which most of the firms represented in the room had no direct interest. Seeing the need, however, for something wider in scope at this particular time, the Association in question had made efforts—he believed in some directions quite successfully—to extend its activities, and in the absence of an Association of firms like those represented that day, quite naturally had put itself forward as representing the bronze and brass foundry industry as a whole.

He had made contact with the secretary of that Association and had assured him that those associated with him had no desire whatsoever to overlap the work of his Association. An invitation was then given to join that Association as a section. This, however, was a course that he could not recommend at this juncture any more than he could recommend non-ferrous interests being looked after by the ironfoundry associations.

In fact, as the arrangements were already more or less complete for running an Association of their own, he took it upon himself to inform the secretary of the Brassfounders' Employers' Association that he was confident the consensus of opinion amongst the firms represented there that day would be that they could not possibly form a branch of that Association.

Non-Ferrous Trade Representation

He was informed that a meeting was held some little time since of the Fuel Efficiency Committee of the Ministry of Fuel and Power, at which a number of industries were represented, such as pottery, glass, laundry, food, etc., but so far as the metal trades were concerned, while the Iron and Steel Federation and the Council of Iron Foundry Associations were represented, there was no official representation from the non-ferrous metal trades, and as the result of this the Fuel Efficiency Committee itself had, at that time, accepted the fact that the whole foundry industries of the country would be taken care of by interests other than those represented at the present meeting.

He thought it would be agreed it would have been a crying shame had the interests of this section of an old-established and large industry been left in other than their own hands, more particularly as the Ministry are anxious to receive information and reports from Industry Committees on the possibility of the assessment of fuel and power consumption per unit of product on which they might possibly base some scale of allocation to industry and in connection with which the brass and bronze founders might easily have been dragged behind the tail of other industries.

In order to deal direct with Industry Committees, the Ministry had formed a special Committee, known as the "Trade Association Sub-Committee."

Information had already been called for, and he believed sent to the Ministry from other industries, which was to be issued in memorandum form and finally discussed at a proposed Conference of Industrial Fuel Efficiency Committees set up by trade and research organisations, which Conference was fixed in London for November 5, and it was hoped by this means that data would be obtained suitable for control purposes.

The industry must have some say in this control, and for this purpose an Association such as has been envisaged was not only considered advisable, but essential. He hoped that to-day it may be able to elect from amongst those present a number of scientists and leaders of non-ferrous metal research who could draw

Bronze and Brass Founders' Association

up a report embodying their views to be considered at the meeting above referred to, or indeed any other.

Whilst the primary reason for getting this Association together was that affecting fuel efficiency, he hoped that, while one or two of them were known to each other, the fact of having met that day as a whole would lay the foundation of a super-structure in which the interests of the industry as a whole could be housed. The potentialities of such an Association were very great. There were many problems with which it could deal in the interests of each firm, and while it was now dealing with the present and the immediate future, the future could not be ignored.

No doubt controls of all descriptions were here to stay, at least for some considerable time, and when the thick veil which now clouded normal business was lifted he thought the Association which was brought into being that day was one which could be of mutual benefit and support, in dealing with whatever conditions may arise in the future affecting the common lot.

Whatever happened as the result of the present war, it would not eliminate the industrial striking power of Continental manufacturers, and he could quite conceive that our present enemies, and even our Allies, had preparations in hand to increase their trade in the world's markets after the war, and he believed if this industry were ready with a clear-cut policy for post-war trade it would show that, though born out of necessity, this Association would live to be of lasting benefit to the interest of the country as a whole and to this industry in particular.

Firms Supporting Association

The firms so far associated with this movement are:—J. Starkie-Gardner, Limited; Brown Bros. & Company, Limited; Rastall & Son, Limited; Arthur Bridgens, Limited; Steven & Struthers; B. Rhodes & Sons; Cockburns, Limited; Aluminium Plant & Vessel Company; Yorkshire Engineering Supplies; Worthington-Simpson, Limited; Merryweather & Sons; Edward Yates & Sons, Limited; Knowsley Cast Metal Company; Sagar-Richards, Limited; Bulls Metal & Melloid Company, Limited; Anti-Attrition Metal Company; Mather & Platt, Limited; Corinthian Bronze Company, Limited; Vowles Aluminium Foundry Company; Glacier Metal Company, Limited; Manganese Bronze & Brass Company; John Holroyd & Company, Limited; Norman Hender & Company; Hayward-Tyler & Company; Phosphor Bronze Company; W. H. A. Robertson & Company; Shipham & Company, Limited; London Metal Warehouses, Limited; Dewrance & Company; J. Stone & Company, Limited; Harland Engineering Company; Whyte & Collins; Jackson Bros. (Milton), Limited; Meigh High Tension Alloys, Limited; C. & L. Hill, Limited; Non-Ferrous Diecasting Company, Limited; Robey & Company, Limited; Fry's Diecastings, Limited; Gresham & Craven, Limited; Edward Barber & Company, Limited; Elliott Bros. (London), Limited; Paisley Brass Works; Mechans, Limited; S. Russell & Sons, Ltd.; Kay & Company (Engineers), Limited; Cornwell & Company, Limited; W. H. Allen, Sons & Company; English Electric Company, Limited; Babcock & Wilcox, Limited; J. I. Thornycroft & Company, Limited; Wm. MacPhail & Sons, Limited; Mirrlees Watson Company, Limited; Reay Brass Foundry Company, Limited; Charles Carr, Limited (including Non-Ferrous Casting Company (Birmingham), Limited).

Finally the Chairman suggested that the objects of the Association might well include:—

(*a*) To represent the industry as a collective body in dealing with Government Departments.

(*b*) To render mutual assistance on technical and productive problems, and to make representations to service departments on inspection procedure specifications, materials, and kindred technical matters.

(*c*) To further both technically and commercially, the extension, where possible, of the trade in the products covered by the Association.

(*d*) To avoid by co-operative action uneconomic and wasteful competition.

(*e*) To co-operate with other organisations in matters of common interest.

(*f*) Generally, to take such action for the protection of the interests of members as may, from time to time, be decided upon.

Mr. S. H. Russell pointed out that his firm like many others were specifically prevented by existing agreements from joining any second association which handled the subject of wages; this ruled out membership of the Brassfounders' Employers' Association.

The proposal to form the new association was enthusiastically endorsed and the chairman cordially thanked for his pioneer work.

Provisional General Council and Technical Committee

The following is a list of members serving on the provisional General Council of the new association: Mr. A. C. Rhodes, of B. Rhodes & Sons; Mr. H. Higgins, of Yorkshire Engineering Supplies; Mr. W. S. Lawson, of Worthington-Simpson, Limited; Mr. H. Yates, of Edward Yates & Sons, Limited; Mr. W. B. D. Brown, of Glacier Metal Company, Limited; Mr. E. A. Mearns, of Manganese Bronze & Brass Company; Mr. N. P. Newman, of Newman, Hender & Company; Mr. W. Smithson, of Phosphor Bronze Company, Limited; Mr. F. G. Burrell, of Shipham & Company, Limited; Mr. W. G. Suffield, of Dewrance & Company, Limited; Mr. H. Bissell, of J. Stone & Company, Limited; Mr. G. Skript, of Langley Alloys, Limited; Mr. S. P. Loosen, of Anti-Attrition Metal Company; Mr. A. J. N. Brown, of Steven & Struthers, Limited; and Mr. Emblem, of Charles Carr, Limited (including Non-Ferrous Casting Company (Birmingham), Limited).

A provisional Technical Committee was also established with the following personnel: Mr. P. B. Higgins, of Yorkshire Engineering Supplies; Mr. L. Harbach, of Worthington-Simpson, Limited; Mr. H. Yates, of Edward Yates & Sons, Limited; Mr. P. T. Holligan, of Glacier Metal Company, Limited; Mr. W. R. Marsland, of Newman Hender & Company;

(*Continued on page* 186.)

UTILISING ATMOSPHERIC PRESSURE IN MAKING STEEL CASTINGS

A New Technique in Gating and Risering Employing "Blind Risers"

By HOWARD F. TAYLOR and EDWARD A. ROMINSKI

(*Concluded from page* 175.)

Advantages of the "Blind Riser"

(1) *Hotter Feed Metal.*—In being able to gate through the blind riser into the casting proper the foundryman enjoys a distinct advantage. The sand around the riser is preheated to a high temperature and when pouring is finished the last metal to enter, and hence the hottest, is in the riser where it should be. Likewise metal in the parts of the casting farthest from the riser is coldest by virtue of being the first to enter and having lost heat continually to the sand in passage. Thermal gradients are thus favourably disposed with the riser being the last to solidify. Proper directional solidification is essential and is generally more easily attained by gating into risers, a simpler procedure with blind risers than with open risers.

(2) *Bottom Gating is Fully Practical.*—Bottom gating is preferred whether blind or open risers are used because there is less erosion of sand surfaces and the metal is generally cleaner. While bottom gating through blind risers is an advantage in all respects, it is many times a source of trouble with open risers. In the latter case the metal for feeding the solidifying casting must come from the top and should be the hottest, but in bottom pouring castings made with open risers this situation is reversed with the colder metal at the top having to do the feeding. This is responsible for a good many defective castings, the blame for which is often laid elsewhere.

Fig. 31 shows how temperatures can vary between the upper and lower sections of even small bottom-poured castings. The illustration is largely self-explanatory. The mould was made up of seven sections of core sand with spiral flow channels tapped off from the header at 3-in. intervals. The spirals serve to measure the fluidity or flowability of the steel at the various levels, and since this quantity has been shown in a previous Naval Research Laboratory publication* to be a direct function of temperature for a given analysis of steel, the length of flow affords a relative indication of the temperature. The time of pouring and height of the test casting are both small compared to large bottom-poured castings, so it can be readily seen that by the time many bottom-poured moulds are completely filled the metal in the riser is nearly ready to solidify.

(3) *Generally Cleaner Castings.*—Experience at those plants in which the blind head is used regularly and at this laboratory indicates that, with good sand practice and proper care, actually fewer bad castings result from dirty moulds than when open risers are used because open risers are a potential source of trouble from foreign matter falling into the mould. With moulds employing blind risers this danger is eliminated except for the relatively small ingate. By gating tangentially into the blind risers a swirling action is set up which causes them to act as skim gates. This prevents sand and dross from entering the mould through the sprue system.

(4) *Saving in Cleaning Cost.*—The most pronounced difference between open and blind risering is in the position of the risers with respect to the sections they feed. The area of contact between the riser and the casting is considerably reduced and more favourably placed in the blind riser and this represents a very real economy in cleaning cost and an improvement of the general appearance of the rough casting after the risers are removed. The blind riser can be placed on flat surfaces and in positions easily accessible to torch and grinder. When open risers are used in the manufacture of valve castings heavy padding of the flanges has been found necessary. This padding, shown in Fig. 32, besides adding materially to the mass of the casting, is inconvenient to remove. Figs. 30 and 32 afford a comparison between the two methods.

(5) *Increased Yield Through More Economical Feeding.*—The shape of the blind riser is advantageous from the design standpoint. The ratio of surface area to volume is considerably less for round feeders than for those of any other shape and, since the rate of solidification is directly proportional to this ratio, the spherical shape of the blind riser as compared to the more usual square or rectangular shape of open risers makes it possible to use smaller heads and effect an increase in casting yield. This increase in yield may or may not be realised, depending upon the type of work being made and the existing method of manufacture. For a comparison, however, it is safe to predict that, if sound castings of types suitable for either method of risering are already being made with open risers and the foundryman proceeds to make them equally sound by the most economical application of blind risers, a definite increase in yield will result. By being able to gate into the risers, this part of the mould is preheated and the hottest metal left for feeding. This automatically disposes temperature gradients toward the risers without the necessity for making them excessively large. It is clear that in those instances where the risers must extend through the cope for a distance in excess of that needed to supply the necessary height of riser to feed the casting properly, a saving will result from the use of the blind type. This is particularly true when it is necessary to feed sections at the bottom or near the centre of large castings.

* Taylor, H., Rominski, E., and Briggs, C.W., "The Fluidity of Ingot Iron and Carbon and Alloy Cast Steel," Transactions, American Foundrymen's Association. Vol. 49 (1941), pp. 1-93.

Atmospheric Pressure in Casting Steel

(6) *More solid castings through a better understanding of the risering process.*—By being able to place blind risers at any point inside the mould, the foundryman has considerably greater feeding possibilities. Hidden sections, bosses, and parts of the casting deep in the drag can be adequately fed without excessive chilling or the use of oversize open risers extending all the way through the cope. The old excuse for unfed sections being "beyond the feeding range" is now more of a myth than ever before. It is believed that a complete understanding of the principles involved in blind risering leads directly to a better understanding of risering in general and of the mechanism of solidification.

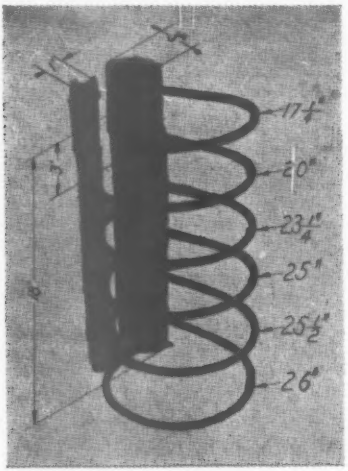

FIG. 31.—CASTING MADE TO SHOW THE TEMPERATURE DISTRIBUTION RESULTING FROM BOTTOM POURING.

It has been stated by persons using the process that since putting it into regular practice they have found it a good deal easier to standardise their gating and risering routine and that in many cases the decrease in height of cope required has been of substantial advantage.

Disadvantages

(1) *Larger Box Size Often Needed.*—By placing the blind risers to the side of the sections they are to feed rather than above them, as in the case of open risers, a larger flask size is necessary for making a given job. However, this is not a very serious matter and may be offset by the decreased height of cope.

(2) *May Trap Dirt or Dross.*—A possible disadvantage in the use of blind risers lies in the possibility of trapping dirt and dross in the main body of the casting if no open riser is present into which it can collect. Only such foreign matter as is already in the casting part of the mould will be harmful, however, as any which originates in the pouring basin, sprue, or ingate will be kept in the blind head by the swirling action of the metal. Good sand practice and care in closing moulds obviate this disadvantage.

(3) *Patent.*—The simple means used by the authors for keeping blind heads open to the atmosphere with sand cores is patented.

Discussion of Practical Features

Since blind head feeding is a relatively new process, a rather detailed discussion of the practical features involved will be offered in the light of present knowledge. Some of the immediate problems confronting the foundryman are:—(1) The choice of the proper and most economical size and shape of head to use; (2) size and shape of neck between riser and casting; and (3) the position of the blind head relative to the section it is to feed.

Size and Shape of Blind Head

Because the amount of liquid shrinkage in any particular casting depends on the temperature of the metal used, no hard-and-fast rule can be laid down which will solve the problem of feeder size for a given section. Variations normally exist in commercial practice between the temperature of the first and last moulds poured from a single ladle, and shrinkages are higher in those shops pouring on the hot side. The differences in cooling rates which depend on the material of the mould, casting contour, and composition of the steel must also be taken into account. Here again it is necessary to draw heavily upon individual experience, but in general judgment is developed after a very short experience with the method. In many cases it is possible to operate on the heavy and safer side and still attain advantages over the open riser so a reasonable time can be allowed to gain experience without the sacrifice of castings or economy.

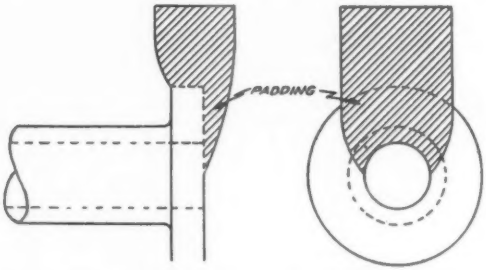

FIG. 32.—SKETCH OF VALVE FLANGE MADE WITH AN OPEN RISER.

Atmospheric Pressure in Casting Steel

By purposely designing oversize and sectioning the feed head with torch or saw, it is possible to arrive at a useful approximation of the volume of feed head needed for a particular section without sacrificing castings and time for experimentation. It is desirable that the final shrinkage cavity in the riser should extend to, but not below, the upper level of the neck leading to the casting. This provides a reasonable, though not excessive, factor of safety against running the cavity into the casting proper and will usually provide for normal variations in the temperature of the metal used for casting.

Some of the pictures of actual patterns included in this Paper give an idea of the size and number of blind heads required for a particular job. The ruler is one foot long and by scaling off the various sections a good approximation of relative sizes can be obtained. If one could estimate the volume of section to be fed, the volume of the blind head required satisfactorily to feed it would seldom be more than 10 per cent. in excess of this amount. Fig. 6 showed the one blind head which was kept open almost completely feeding another of the same size which was not. The shape of blind heads for maximum feeding should be that of a hemisphere superimposed upon a cylinder with the overall height above the bottom of the ingate into the casting at least one inch greater than the diameter.

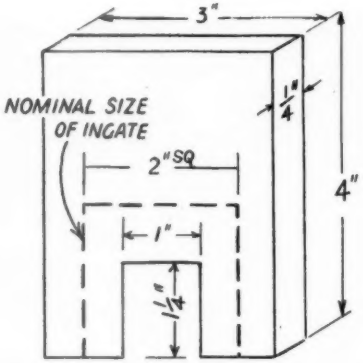

FIG. 33.—DETAILS OF THE CORE USED FOR REDUCING THE SIZE OF NECK INTO THE CASTING.

Dimensions of Neck and Ingate

Fig. 22 indicates the neck into the casting as of a square cross-section with the upper edges rounded. An approximate 2 to 1 ratio of neck size to the thickness of the section to be fed holds well for small valve flanges and similar shapes but must be modified in proportion to feed larger sections. Naturally, the only requirement is that it shall not freeze off prematurely, and this is influenced not only by its size and shape but by the amount of metal flowed through in filling the casting. This ratio would decrease inversely with section thickness, but the neck will never be smaller than the section to which it is attached.

In Fig. 6 the neck was much smaller than the largest section and feeding was possible because the neck solidified slowly due to the narrowness of the section of sand between the riser and the body of the casting. Heat loss through this section is very slow and generally the sand around the neck is preheated by metal flowing through this channel to fill the casting. However, in these tests a runner was connected, directly to each blind head, and yet the neck remained open nearly long enough to complete feeding. The hot metal continuously being forced into the section to be fed undoubtedly retarded the solidification of the neck.

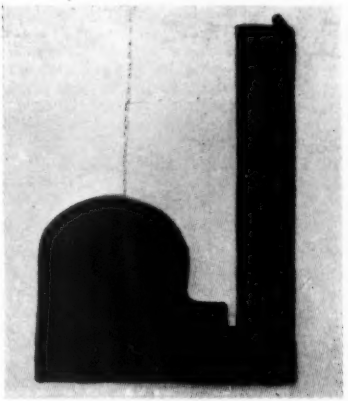

FIG. 34.—CASTING MADE WITH A CHOKE CORE AT THE NECK.

In attempting to make removal of the feed head as simple as possible the principle of the Washburn core was applied to one test casting. A strong linseed oil plate core, ¼ in. thick, was made with a rectangular section 1 in. by 1¼ in. cut from one side as in Fig. 33. This was placed in the mould across the neck in position to give the effect shown in Fig. 34. The purpose was to see if the blind head would feed properly through this necked down portion. If this were possible the removal of blind risers would be greatly simplified. The original cross-section area of the ingate was approximately 4 sq. in., as compared to 1¼ sq. in. at the choke. The photograph of the casting indicates that the method will work satisfactorily, but too few tests have been made to

Atmospheric Pressure in Casting Steel

establish this as a reliable practice. The success of the method depends upon the core being thin enough to heat up readily to the temperature of the metal flowing through. This prevents premature chilling of the section. In using the choke it should be placed at least one-fourth inch from the casting to prevent gouging into it during removal of the risers. Also the amount of choke must be carefully regulated.

The size of ingate varies but should be considerably smaller than the neck. This causes it to freeze off early and complete the closed system during solidification of the casting and riser.

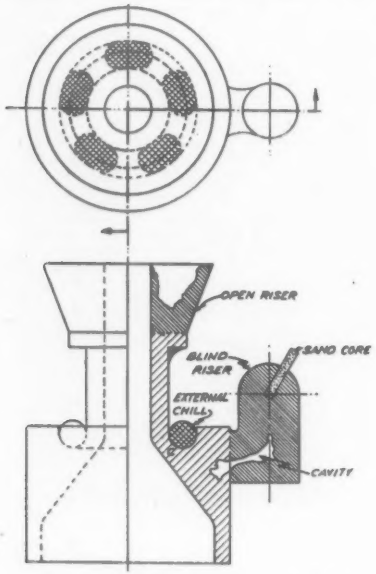

FIG. 35.—SHOWING NECESSITY FOR INDIVIDUAL ZONES OF FEEDING FOR EACH RISER.

Position of Blind Heads

Some blind heads are placed at the side of one face of the casting and gated to the flat surface. The head is placed as close to the casting as possible and in a position which makes moulding easiest.

The bottom of the blind head may be on the parting line with the neck to the casting entirely in the cope, or it may be partly or wholly in the drag. In general for valve manufacture the flanges are headed partly in the drag and partly in the cope. For many complicated castings the blind heads must necessarily be made up in cores. The riser may be below the highest part of the section to be fed but, as pointed out earlier, this is usually not the case.

When several risers are used at different levels in the same casting it is essential that a particular zone of feeding be relegated to each blind head. Fig. 35 is a sketch showing the necessity for this precaution. The open riser used in this particular case would react similarly if it were a blind type at the same level. This represents roughly an actual casting and the blind riser failed to function, being in fact nearly solid. The cavities were found in the casting and open riser in the positions shown. The reason for this was that since both risers were initially open to the atmosphere, the net advantage of the blind riser in this respect was zero, and due to the greater ferrostatic pressure of the open riser, because of its superior position, the metal was forced through the system to actually feed the blind riser.

By the time the narrow section of metal shown at "c" had solidified and shut off the hydraulic contact between the two feed heads metal had solidified beyond the end of the sand core and made it impossible for atmospheric pressure to act. The section to be further fed was choked off at "c" and solidified with the shrinkage shown. The casting could have been made perfectly sound without altering the method of heading in any way. The only change would be to place external metal chills, cast to shape, around the neck of the casting at point "c." This would chill the metal at this point, separate the two heavy sections, and allow each riser to function independently of the other.

FIG. 36.—AN OPEN RISER COMBINED WITH A PARTIALLY BLIND RISER FOR FEEDING A YOKE CASTING.

Use of Chills and Venting

The use of external chills is quite often erroneously frowned upon, but when properly

Atmospheric Pressure in Casting Steel

used, chills can aid greatly in controlling solidification. Since this is not a discussion of chills, no elaboration will be attempted, but it is true that several shops apply them with full satisfaction and a greatly enhanced yield of radiographically sound castings. External chills can be used to great advantage in getting the maximum benefit from blind risers, but are actually less essential to their satisfactory operation than is the case with open risers since blind risers can be placed wherever needed.

Venting blind head work is essentially the same as for open risers except that thin rectangular "lifter" vents are provided on the upper surfaces of the casting at points shown by the small prints on several of the patterns. The moulder's lifter tool is used to make the vent. The blind heads are also vented either with a small lift vent if open risers are incorporated in the system, or with larger round vents, one-half inch or more in diameter, if there are no open risers. The larger vents are used to indicate when the moulds are filled. Air and gases must be amply vented so the mould will fill readily and completely.

Examples of Commercial Castings

Fig. 36 shows an open riser combined with a partially blinded riser for making the yoke casting. The sand core is inserted at the shoulder and ensures keeping the system open to the atmosphere. The blind head would have been just as efficient with the smaller vent which is normally used. This particular casting lends itself well to blind head feeding, and is an interesting study in directional solidification. The sections are slightly tapered toward the end away from the risers making satisfactory feeding from the one end possible. An external cap chill for the boss eliminates the need for a riser at this point and aids the already favourably disposed thermal gradients.

The photographs (not reproduced) of the various commercial castings and patterns do not necessarily show the only way, or even the best way, of positioning the blind risers, but do represent a method which has been applied with complete success. It is axiomatic that the size, number and position of blind risers will vary from plant to plant according to the experience of the foundryman in charge, just as always has been, and still is, the case with open risers.

One very useful application of blind risers which is not shown here is for the elimination of cavities at places where the ingate joins the casting. Because of the enlarged cross-section at this juncture, and because of the metal flowing through, a serious hot spot occurs which often is not fed by ordinary risering. The result is a cavity which may reach to the surface at one of the sharp corners. Contrary to popular belief, these enlarged cavities are not caused by volatile gases, but by atmospheric pressure forcing its way in to relieve the negative pressure developing from shrinkage at the hot spot. This principle has been clearly discussed in connection with Fig. 14 above. A blind riser placed at this point serves the double purpose of preventing the defect and of acting as a skim gate by swirling the metal through the riser and then into the casting.

Acknowledgment

The authors wish to express appreciation to their colleagues of the Naval Research Laboratory staff, to Mr. H. D. Phillips, and to the Dodge Steel Company. They are also greatly indebted to the Navy Department for sponsoring the work and for permission to publish the results.

FEDERATION OF BRITISH INDUSTRIES

The Federation has issued from its offices at 21, Tothill Street, London, S.W.1, an eight-page brochure which details its activities. Normally, it has about one hundred overseas representatives and a further dozen located in the large provincial cities. These representatives are established for the purpose of answering commercial enquiries emanating from firms associated with the Federation, membership of which is either individual or through a trade association. The only activity, as far as can be seen, which the Federation does not undertake is that of wages negotiation. It has been established that this important activity is best left to organisations specially developed for the purpose, so that misunderstandings are unlikely to arise. Generally speaking, the work of the Federation embraces general trade policy, taxation, transport, war contracts, A.R.P., war risks, trade organisations, export and import problems, raw materials and priorities, limitations of supplies, consumer rationing orders, prices of goods legislation and price control orders, tariffs and quotas and statistical work and general intelligence. Of immediate interest is their claim to give "technical guidance on efficient fuel practice in the workshop." How much of this work can better be done by the Federation than by a well-organised trade association it is difficult to determine. In many instances the problems of various industries are of a parallel character and their solution by a central body saves much time and money, but in other cases, where conditions differ greatly, only chaos arises. At the moment, we have in mind the means for effecting concentration as applied to various industries. Actually, the work of the F.B.I. supplements and does supersede the work of the larger trade associations, the collaboration of so many of which the Federation enjoys.

The Nickel Bulletin

The August/September issue is particularly informative and well balanced. It deals with the electrodeposition of hard nickel, miscellaneous war-time American and British specifications, the creep strength of copper base alloys at elevated temperatures, and the effect of steel composition on weld hardening. The last-named Paper, which is of current interest, is abstracted at some length.

THE VALUE OF SCIENCE

WEST YORKS PRESIDENTIAL ADDRESS

The West Riding of Yorkshire Branch of the Institute of British Foundrymen opened the new session on October 10, when the President (Mr. F. Oldershaw, of Wakefield) entertained the members to tea at the refectory of Bradford Technical College, and afterwards gave his presidential address. Mr. L. Turner (Elland), senior Vice-President, presided over the proceedings after tea and during the subsequent general meeting, when discussion was resumed on the President's Paper, "Iron, Manganese and Sulphur," delivered at the end of last session (April 25), and published in FOUNDRY TRADE JOURNAL of June 4, 1942.

In the course of his presidential address Mr. Oldershaw devoted more consideration to the value of science in general than to any special application of it to the foundry industry, having in mind the fact that he had particularised on aspects of foundry work in his Paper, to be discussed later in the evening. During the whole of his career, he said, he recalled no occasion which had given him more pleasure and pride than that of his first meeting as West Yorkshire Branch President, and he extended his thanks for the honour done him.

Looking back over his 31 years' experience in this industry, the President said he had been impressed by the vast changes which had taken place; changes brought about to a large extent by the application of scientific principles and the growing demand for high quality products to comply with rigid specifications. Great credit is due to past and present day foundrymen, metallurgists and research workers, and also to the Institute, for their efforts in the solution of both practical and theoretical problems. He stressed the growing need for scientific research workers with the necessary training.

Addressing his remarks especially to the younger members of the Branch in an effort to explain the meaning of science, Mr. Oldershaw said science, in short, embraced the sum total of human knowledge and ranged over the whole realm of nature. Science was not merely a mass of empirical knowledge gained by observation and experiment, but an organised body of facts which had been co-ordinated and generalised into a system. Science assumed that nature was a harmonious unity, and then sought a complete knowledge of the multitude of inter-related parts of the Universe which acted and reacted to one another. The edifice of science thus rested on a foundation of reliable facts which, when recorded and their reliability ascertained, comprise the accumulated knowledge of the present civilisation, but they alone were not science. The process of classification and correlation of these facts was one of the methods of scientific investigation, and knowledge so systematised was scientific knowledge.

Much of the so-called science of ancient times and the Middle Ages was rendered worthless by neglect of this essential precaution. What was lacking was the desire or inclination to test the truth of a statement. Stories were repeated by writer after writer without the slightest attempts at verification. Science must work on proved facts and upon them found hypotheses. It was a popular belief that the aim of science was to explain things. As a matter of fact, the so-called explanations of science did not usually get much beyond describing the observed facts in the simplest possible terms, so as to make their relations with one another clear and intelligible.

The description might emphasise the history of a phenomenon, or the conditions under which the phenomenon occurred. In other words, science might explain a fact by describing how one event was determined by an antecedent action and how one set of conditions—"the cause"—can give rise to another set of conditions—"the effect." Although every effect can be traced to a cause, phenomena follow one another as links in an unbroken chain, and it was soon realised that the cause of a phenomenon was an effect which itself needed explaining, so that causes would be traced back in a never-ending chain of events.

The mind cannot receive a long series of details without connecting them by a common bond; similarly in an attempt to find the cause of many phenomena man was compelled to build an imaginary model showing how a given set of conditions was always followed by particular effects—thus a hypothesis or theory was set up. The next step was to test the hypothesis by using it to predict what ought to take place in a given set of conditions, if it was true. These predictions were then submitted to the test of experiment. The hypothesis thus served to prompt new experiments and to indicate the conditions under which the search for new facts was likely to be successful.

Growing Need of Research Workers

Here the growing need for scientific workers, with properly organised training, was shown. Such a scientist would be highly developed for research work and would not be starting from first principles. He would have the proved and tested knowledge of generations behind him. If testing by experiment failed to confirm the predictions, the hypothesis must be discarded and a new one framed and tested. If, on the other hand, the predictions prove correct, it ultimately became a theory and thus an important part of science.

Thus experiment was the hand-maiden of science, for it was really a method of observation which was employed either to test the validity of a recorded statement or when facts are so masked by other conditions that they cannot be accurately observed unless the obscuring conditions are suppressed. The chemist would make little progress if it were only possible to make observations as they occur in nature, and not under controlled conditions. Hence the value of the thoroughly trained research worker.

If we considered the educational facilities and opportunities afforded to-day and also the young people who were taking advantage of them, one would find some very intelligent youngsters whose main object was not to obtain a large salary at the earliest possible moment, but who were prepared to devote the utmost time and energy in studying the scientific side of the industry

(*Continued on page* 200.)

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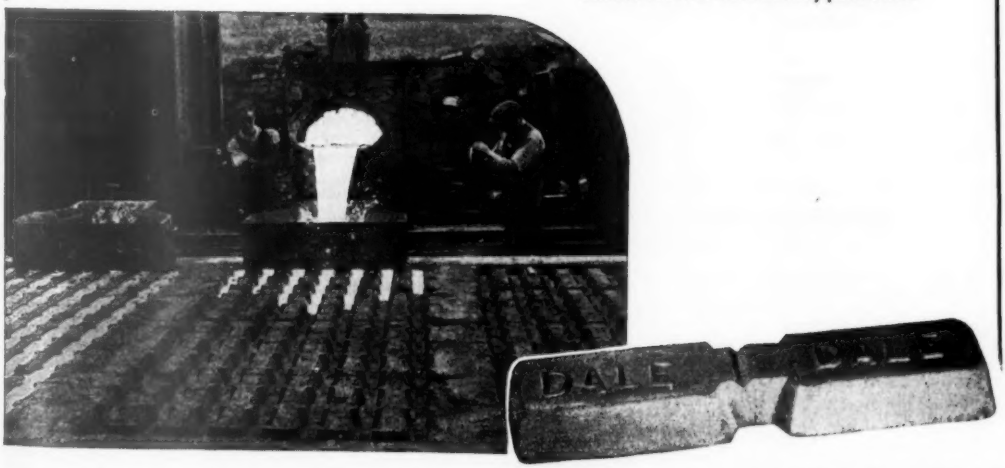

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PERSONAL

MR. B. A. BROMWICH has been elected a director of Richard Hill & Company, Limited, wire drawers, etc., of Middlesbrough.

MR. JOHN BOLTON, the acting secretary of the Institute of British Foundrymen, was last Saturday married to Miss Muriel Galloway, of Manchester.

SIR AMOS L. AYRE, Deputy Controller of Merchant Shipbuilding and Repairs, and Director of Merchant Shipbuilding, has been elected an Honorary Fellow of the North-East Coast Institution of Engineers and Shipbuilders.

COL. WALTER MACFARLANE, D.S.O., chairman of Walter Macfarlane & Company, Limited, Saracen Foundry, Possilpark, Glasgow, has been appointed Collector of the Trades House of Glasgow in succession to Mr. Daniel Duncan.

MR. CECIL BENTHAM has been elected president of the British Engineers' Association for the ensuing year. He is chairman and managing director of Henry Simon, Limited, Cheadle Heath, and at the present time, on behalf of the Machine Tool Control and the Admiralty, is investigating the machinery equipment of shipyards and marine engine works.

"FAIR WAGES" CLAUSE

A new "fair wages" clause for incorporation in Government contracts has been prepared by the Government in consultation with the British Employers' Confederation and the T.U.C. and the draft published as a White Paper.

The standard of fair wages will no longer be solely the practice of "good employers" in the district. The employer will be required to observe such conditions as have been established for the trade or industry in the district by representative joint machinery of negotiation or by arbitration. The new definition also specifically requires the contractor to observe "fair" conditions of labour as well as "fair" wages. It is laid down that the contractor must recognise the freedom of his workpeople to be members of trade unions.

THE VALUE OF SCIENCE

(*Concluded from page* 198.)

with a view to fitting themselves to fill responsible positions requiring organised scientific and technical training. It was to the capabilities of these young men that the future of the industry looked, and it was up to the present generation to see to it that they were given every opportunity of carrying on the traditions of the foundry and raising the standards still further. The scope of the industry to-day was very wide, and the demand made upon it would tend to be greater as time went on.

Hearty thanks to the President were accorded, on the motion of Mr. D. Jepson, M.Sc., seconded by Mr. G. W. Nichols.

HAULBOWLINE STEEL MILLS

EIRE GOVERNMENT'S FINANCIAL INTEREST

The position to date with regard to the operation of the steel mills at Haulbowline, Cork, was outlined by Mr. Lemass, Minister for Supplies, in the Senate, Dublin, in reply to questions. The Minister said that the project was started by a private company, financed by private money. The construction of the works began shortly before the war. In September, 1939, they were not completed. A merchant mill was in operation, manufacturing from imported steel billets, but the rest had not been completed—the furnaces had not been completed. The war made it impossible to complete the construction of the mills. Materials and machinery on order from the Continent could not be obtained. The result was that it was very difficult for the company to carry on. A large part of its capital was unremunerative, being represented by the partly completed furnaces and the mills standing idle, waiting for the machinery that could not be obtained. The company imported steel billets from Britain and afterwards from the United States, but financial difficulties accumulated, and, finally, last year the company could not pay the interest on its debentures. The debenture holders appointed a receiver, but the receiver failed to dispose of the property as a going concern. The only alternative was to sell the assets at a break-up sale, and that was unlikely to realise enough to pay the debenture holders.

It was appreciated that the supply of steel billets from the United States would dry up, and the Eire Government took the step of buying steel billets, but the ban upon the export of steel billets from the United States came into force before the whole quantity purchased could be shipped. Some, however, were shipped. It was clear that efforts to get the business going by selling to somebody prepared to operate the company were not going to succeed, and the Government stepped in and offered a loan of £200,000 under certain conditions. Whether it would be possible to complete the furnaces he could not say, but he was told that there was some ground for optimism. Even if the equipment could be procured it would take many months before it could be installed and the furnaces put into position to deal with scrap steel. There was available to the company a considerable tonnage of scrap. Some had been imported, and a smaller amount came fortuitously from a wrecked ship. On the basis of that raw material available the mill would be restarted for a time, but only for a time, and the operation of the mill for the duration of the war depended entirely on the success of the efforts of the Board to get the furnaces going. It was essential that the mill should be got going. There was virtually no commodity of which there was the same difficulty of securing supplies as of steel.

MR. A. J. MURPHY, M.Sc., vice-president of the London Branch of the Institute of British Foundrymen, has been elected a vice-president of the Institute of Metals.

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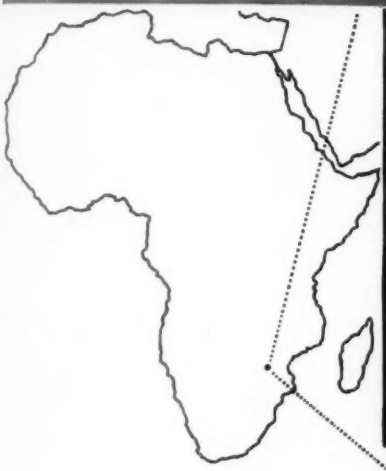

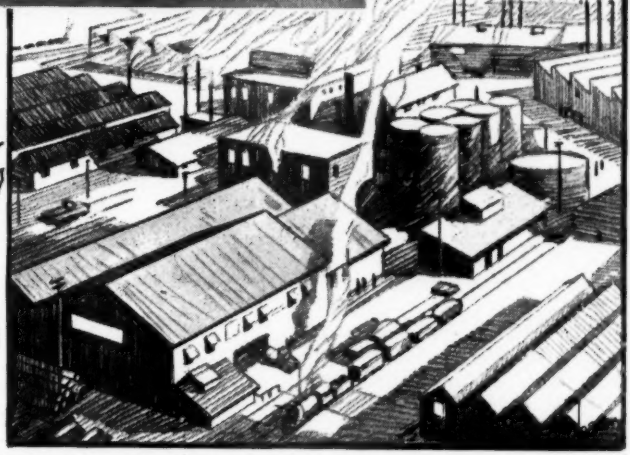

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ALLOCATION OF PRODUCTION RESOURCES

USE OF SKILLED LABOUR

Reallocation of the production resources of the country has been decided upon by the Government, where necessary in the national interest. The proposals were outlined by the Minister of Production, Mr. Lyttelton, and will be put into operation at once.

Mr. Lyttelton said that our war production, with that of the United States, Canada, and the rest of the Empire, must be planned as a comprehensive whole; but, taking this country alone, the period of widespread expansion of resources was passing. The main emphasis must now be laid on securing the best possible results from the resources available to us. Those resources were our own man-power and machine-tools and the materials allocated to us from the common pool of the United Nations. To continue to expand our production as planned meant more output from the same machines, the same floor space, the same managements, technicians, and operatives. It meant fewer delays, regularity in flow both of orders and of deliveries, better balance at all stages of production.

Right Men in the Right Jobs

Correction of imperfections and maladjustments in all those details was to a large extent a matter of reallocation, Mr. Lyttelton continued. The most important thing of all was to see that man-power had the right jobs, and that machine tools and buildings were used to the greatest advantage. The aim could be achieved sometimes by redistribution of the work done in each plant, sometimes by improvements in management, or by arranging for groupings or amalgamations of firms. At the same time there were some undertakings whose resources were so meagre that labour was their only valuable asset, whereas others were well equipped in everything except labour. We must now see that the first of these classes received no further orders, so that their man-power could be reallocated to firms of the other class.

He proposed to take corrective measures wherever there came to light a factory in which labour was misapplied or the resources in plant or technical ability were too slight to yield the production which we must have. The first attempt would always be to secure the desired result by rearranging contracts or by an improvement in management. The next alternative would be to devise groupings or affiliations that would enlarge the unit of production and so make possible a better balance of plant.

There were many instances where individuals and firms, in their anxiety to help in war production, had secured from other firms contracts quite unsuited to their technique or equipment. They were using skilled and other labour that would contribute far more to efficient war production if it could be given employment in factories which were properly supplied with everything except labour. In such instances, if no other remedies could be applied, he intended to prohibit the undertakings from taking further orders of the same kind. Their labour would then be transferred where it could be employed more usefully.

New Undertakings Controlled

In fairness to existing undertakings and to prevent any further dissipation of resources, it was clearly necessary to control the establishment of new undertakings which were not likely to be effective units of production. The President of the Board of Trade had therefore amended the Location of Industry (Restriction) Order so as to make it necessary to obtain a licence for any manufacturing undertaking coming into existence or changing the nature of its activities.

Another kind of reshuffle which had now become necessary was the removal of certain industrial undertakings—so far as possible those engaged in less essential work—from highly congested areas to other parts of the country. When the removal of a firm was decided on it would be arranged for the firm's plant and key personnel to be transferred; but the bulk of their labour would be left behind to be redirected to other work near the workpeople's homes.

OBITUARY

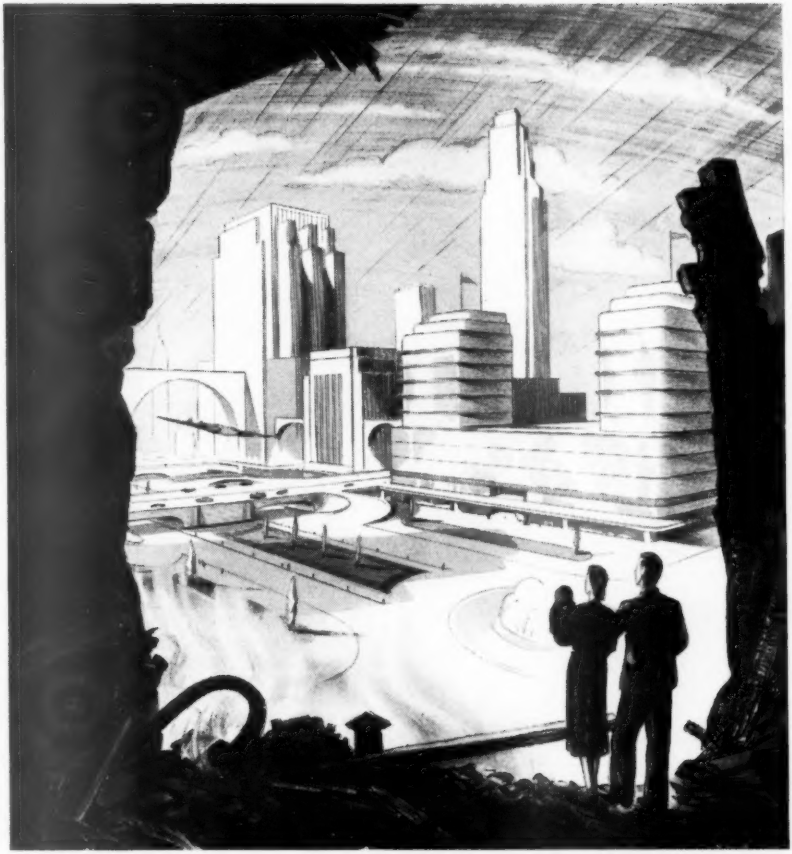
MR. JOHN MCLAREN, a director of Brown & Glegg, Limited, iron and steel merchants, died in Edinburgh recently, aged 76.

MR. ERNEST COTTON, proprietor of George Cotton & Sons, steel merchants and spring manufacturers, of London, E.C.1, died recently.

MR. NORMAN COCKBURN died recently at Edinburgh, aged 72. He was a former director of Allied Ironfounders, Limited, and an ex-chairman and managing director of M. Cockburn & Company, Limited, Falkirk. Mr. Cockburn retired from business four years ago.

MR. THOMAS RUSSELL, of Thomas Russell & Son, structural engineers and iron and steel merchants, Dundee, died recently, at the age of 81. He was apprenticed to his father in 1878 as a blacksmith and engineer in Dundee, and when his father died in 1881 he managed the firm. He bought the St. Andrews Ironworks and carried them on until 1921, when he acquired works in Graham Street, Dundee, with his son as a partner.

MR. HORACE BROADBENT died on October 20 at his home at Huddersfield, aged 79. He was chairman of Thomas Broadbent & Sons, Limited, electrical and mechanical engineers, of Huddersfield. Mr. Broadbent was a pioneer in the development of hydro-extraction and electric cranes and the patentee of many improvements in the design of centrifugal machinery. His firm, it is claimed, were the first makers of the direct steam-driven hydro-extractors, direct electrically driven extractors and of electric overhead travelling cranes. Mr. Broadbent himself is said to have designed the first electric travelling crane made in Great Britain, and was patentee of a centrifugal friction clutch.



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COMPANY NEWS

(Figures for previous year in brackets.)

Claud Hamilton—Dividend of 2% (3%).

Tweedales & Smalley—Interim dividend of 5% (2½%).

Babcock & Wilcox—Interim ordinary dividend of 4% (same).

James H. Lamont & Company—Interim dividend of 7½% (same).

Braithwaite & Company, Engineers—Final dividend of 3%, making 5% (same).

Herbert Morris—Final dividend of 15%, free of tax, making 20%, tax free, for the year to July 31 last (same.)

Crabtree Electrical Industries—Final dividend of 5% and a cash bonus of 7½% on the ordinary shares, making a total of 17½% (same).

William Bayliss—Profit for the year ended July 31, £10,716; depreciation, £668; income-tax and E.P.T., £6,650; net profit, £3,398; to general reserve, £1,000; dividend of 7½%, less tax, £2,250; forward, £3,211 (£3,063).

R. & W. Hawthorn Leslie—Profit, after providing for depreciation, taxation and contingencies, £132,034 (£133,471); total dividend, including 5% bonus, of 15% (same); to reserve, £50,000; forward, £53,148 (£52,826).

Fairbairn Lawson Combe Barbour—Dividends on the 10% non-cumulative redeemable £1 preference shares of 10% (same), on the 1st preferred ordinary of 1s. per share (nil), and on the 1st ordinary of 10% (nil).

Tinsley Rolling Mills Company—Profit for year to June 30, £6,992 (£14,950); dividends on the preference shares, £850; dividend of 10% (same) on the ordinary shares, £2,000; to depreciation account, £2,000; to taxation reserve, £1,750 (£10,000); forward, £5,293 (£4,901).

Kayser, Ellison & Company—Profit for the year to June 30, after taxation, £93,167 (£114,102); to depreciation reserve, £35,000 (£40,000); to general reserve, £10,000 (£15,000); to staff fund, £5,000 (same); final ordinary dividend of 12½%, making 17½% (same); forward, £11,890 (£18,473).

Parsons Marine Steam Turbine Company—Net profit for the year ended June 30, after writing off expenditure on experimental and pioneer work and providing for depreciation, upkeep of patents, and taxation, £57,305 (£53,066); to special war reserve, £25,000; dividend of 10% (same), £31,692; forward, £16,030 (£15,417).

Horseley Bridge & Thomas Piggott—Trading profit for the year to June 30, £157,203 (£149,793); depreciation, £21,000 (£21,000); war damage insurance, £3,172 (£7,270); reserve for taxation, £86,000 (£81,000); net profit, £41,121 (£36,506); to reserves, £10,000 (£10,000); ordinary dividend of 12½% (same), £14,063; forward, £52,417 (£36,697).

Wright, Bindley & Gell—Net profit for the period July 1, 1941, to June 27, 1942, £10,636 (£10,456 for year); dividend of 7% on the preferred ordinary shares, £8,690; additional dividend on the preferred ordinary shares of ¼d. per share, £388 (same); dividend on the deferred shares of 2d. per share, or 6¾%, £1,135 (same); forward, £2,244 (£1,849).

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Ackworth Engineering Company—£3,000. W. and E. Storey, 92, Wakefield Road, Ackworth, near Pontefract.

Low's Proprietary, 12, Waterloo Road, Wolverhampton—Engineers, founders, etc. £1,000. W. J. Jones and N. J. Wilkes.

Oxley & Fowler—Engineers, etc. £9,000. H. Oxley and J. E. Fowler, Byeways, Pledwick Lane, New Millerdam, Wakefield.

K. J. Langley, One Elm Works, Arden Street, Stratford-on-Avon—Scrap iron and metal merchants. £2,000. K. J. Langley.

British Laminated Brass Company—£15,000. P. G. Griffith, G. R. Pooley, and R. Templeman, 10, Kendrick Road, Slough, Bucks.

W. & W. Manufacturing Company, 11B, Strafford Road, Acton, Middlesex—To take over the business of engineers carried on by the Acton Manufacturing Company, Limited. £5,000.

PHOTOGRAPHY IN INDUSTRY

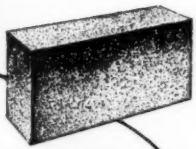
The Association of Scientific Workers is promoting an exhibition, "Photography in Industry and Science," to be held during November in the rooms of the Royal Photographic Society at 16. Prince's Gate, London, S.W.7. This exhibition will be opened by Sir Robert Watson Watt, F.R.S., under the chairmanship of Mr. D. McMaster (Pres., R.P.S.) on October 31, at 3 p.m. The field covered by the exhibits will be wide, and have particular reference to the war effort, including work on machine movement analysis, radiography of castings, etc., mapping and surveying, mass examination for tuberculosis, crystallography, astronomy, nuclear physics, template making, etc.

STEEL SCRAP FOR THE U.S.A.

It is reported that owing to the improved scrap position in this country, discussions are taking place with the authorities in the United States with a view to arranging shipments of scrap to relieve the shortage there. Stocks in Great Britain have been augmented by scrap arising from the large tonnages of semi-finished steel sent over here under Lease-Lend arrangements. This scrap would have accrued to American works if finished steel had been shipped, and the reported negotiations are said to have been initiated in order to redress the balance and relieve the acute shortage of scrap in the U.S.A.

A THREE-DAY CONFERENCE on quality control of production was held recently at the Northampton Polytechnic, London, under the auspices of the Board of Education. Eighty teachers in technological colleges and schools attended.

WARTIME DEMANDS BROOK NO DELAY



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Raw Material Markets

IRON AND STEEL

Both iron and steel makers are largely concerned at the present time with the production of the better qualities. In the steel section, makers of armaments, munitions, etc., are absorbing very substantial tonnages of special steels, including alloy and high-carbon descriptions. Unfortunately, the output of hematite, low-phosphorus iron and other high-grade irons has had to be curtailed owing to the shortage of imported ores, so that consumption necessarily has declined. There are ample tonnages of high-phosphorus iron and other qualities made from home-produced ores, and these grades are being utilised in many cases by the heavy engineers, who normally rely solely on the higher grades. The pig-iron requirements of the heavy engineering works are at peak levels, as these concerns are catering for the needs of Government departments, and many works have their order-books filled with priority contracts.

The position of the light foundry trade is far less happy than that of makers of heavy castings. Many light foundries are being closed down under the concentration-of-industry plans initiated by the Government, as the volume of essential work on their books, generally speaking, is quite small. Light castings are not much needed for the war machine, while there is little moving in the ordinary trade, owing to the various restrictions imposed on business of this nature. The export market, too, is very quiet, and this was formerly an important outlet for the light foundry industry.

Deliveries of foundry coke from Durham, Wales and other districts continue to flow quite freely, and consumers are getting all they require. Many buyers have, of course, stocked large tonnages, but users are not always in a position to accumulate reserves, and many have to rely on small deliveries at frequent intervals. For delivery to Birmingham and Black Country stations, the current price of Durham best foundry coke is 69s. 3d. per ton.

The expansion in the production of high-carbon, alloy and other special grades of steel has been phenomenal, but demand continues to outstrip the output and no opportunity is being lost of increasing production facilities. Engineers engaged on Government contracts are making heavy demands on the steel mills for the special qualities, and it is certain that there will be no falling off while the need for armaments, etc., remains of paramount importance. Structural steel is still being called for in increased tonnages, and most works in this section are now busy. Steel-plate producers are actively employed, orders for plates from the shipbuilders being especially heavy. Sheets of special qualities are in keen request, and the mills are operating to capacity.

Deliveries of the lighter grades of scrap metal have been plentiful for some time past and consumers in most cases have as much of this type of scrap as they can accommodate. The heavier descriptions, however, are still being called for, and sellers have no difficulty in disposing of all the material they can offer. Steelmakers are particularly large consumers of heavy scrap and are anxious to enlarge their stocks as a precaution against delays in deliveries during the winter months.

NON-FERROUS METALS

There is not much copper to spare after urgent requirements of the war machine have been satisfied, and it is not surprising, therefore, that the Control authorities scrutinise very carefully all applications for licences for fresh deliveries. No doubt certain quantities of copper have been put into stock, but these will not be drawn upon to meet other than really urgent needs, as it is necessary to keep down imports to the minimum. The use of secondary metal is being encouraged, and this is undoubtedly helping to limit the use of new metal.

The dominating factors in tin at the moment are the need for expanding production and the necessity for economy. Output is being stepped up where possible, but there are difficulties which preclude any material development in the near future. In Bolivia, for example, the tinfields are experiencing a shortage of labour, while Bolivian producers are also faced with lack of mining equipment and materials. The Nigerian tin producers are striving to raise the level of their outputs, but they, too, have to overcome certain difficulties. It would seem that the Belgian Congo is the best placed for achieving prompt expansion, and experts there are hopeful of improving their outputs. In Cornwall the shortage of suitable labour has not been solved, and the Lord Lieutenant of the County has appealed to the youth of Cornwall to work in the tin mines. Men between 18½ and 25 who volunteer will not be called up for military service.

Statistics on production of secondary non-ferrous metals in the United States during the past year, which have been issued by the Bureau of Mines, show a marked increase in secondary tin output. The figure reported for tin was 42,033 short tons, and consisted of 29,606 tons of old scrap and 12,427 tons of "new" scrap which was derived through processing of new materials. The recovery of secondary tin in 1940 totalled 33,222 short tons. In discussing the 1941 statistics the Bureau states that of the 5,900 tons of unalloyed secondary tin recovered, 5,089 tons was produced as pig-tin from tinplate scrap at seven detinning plants. Almost one-fourth of the 1941 yield of secondary tin was produced in the form of tin-base products, including metallic tin, tin babbitts, and tin chemicals. The next 40 per cent. emerged as the tin content of lead-base alloys such as solder and type-metal, and the remaining 36 per cent. filled the greater part of the tin requirements in secondary brass and bronze products. Only 23 per cent. of the total secondary tin recovered was supplied by tin-base scrap, compared with 39 per cent. from copper-base scrap, 23 per cent. from lead-base scrap, and 15 per cent. from tinplate scrap.

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